

Soybean Lipoxygenase L1: Comparison of the Fe^{III} (active) Fe^{II} (resting) Forms of the Enzyme

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Introduction: Lipoxygenases are non-heme iron enzymes that catalyze the dioxygenation of unsaturated fatty acid to hydroperoxides. Lipoxygenase activities are important in plants as well as in mammalian organisms. In plants, the preferred substrate is linoleic acid. In mammals, lipoxygenases convert arachidonic acid into hydroperoxides, precursors of lipoxins and leukotrienes. These compounds are associated with a range of inflammatory diseases such as asthma and inflammatory bowel disease. Lipoxygenases can exist in two oxidation states: an Fe^{II} and an Fe^{III} state. All structures reported to-date are those of the Fe^{II} resting state (1-3) In the Fe^{II} structures the iron has octahedral coordination. Four of the ligands, HIS-499, HIS-504, HIS-690 and the terminal carboxyl of Ile839, are direct iron ligands (distance 2.0 - 2.2 Å). The other two coordination positions are occupied by Asn694 and a water molecule that are at longer, non-liganding distances (~3.0 Å).

Methods and Materials: X-ray Crystallography, Frozen crystals of the activated enzyme. Molecular Replacement (AmoRe). Difference Fourier (CNS-Refinement).

Results: Fe^{III} soybean lipoxygenase crystals belong to space group P2₁2₁2₁ with cell dimension a = 68.9 Å, b = 120.3 Å and c = 119.1 Å. The structure was refined to an R_{value} of 21%. The binding site of this form resembles that of the Fe^{II} form, but shows significant changes especially in the coordination of the iron.

References:

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